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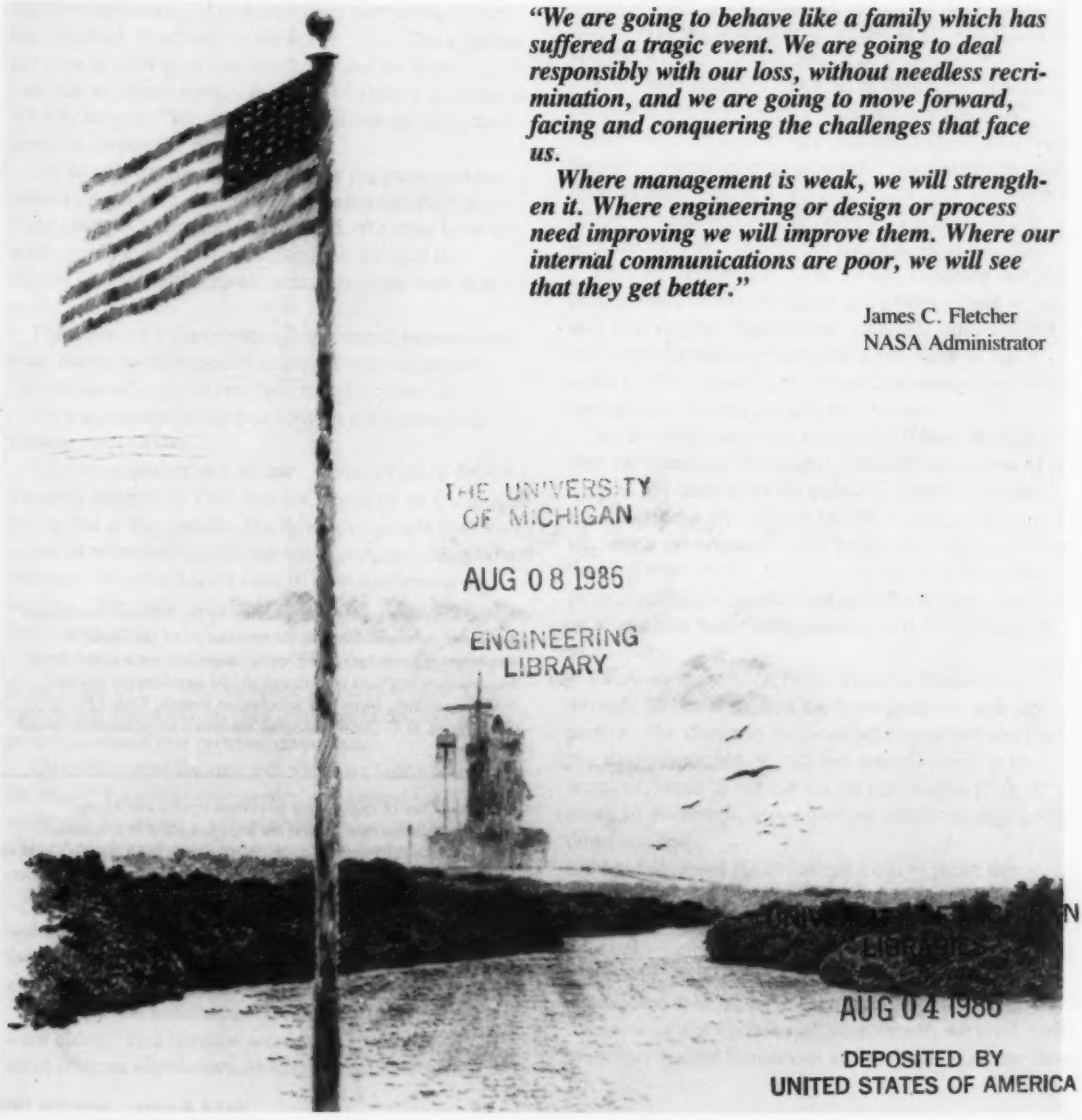

"We are going to behave like a family which has suffered a tragic event. We are going to deal responsibly with our loss, without needless recrimination, and we are going to move forward, facing and conquering the challenges that face us.

Where management is weak, we will strengthen it. Where engineering or design or process need improving we will improve them. Where our internal communications are poor, we will see that they get better."

James C. Fletcher
NASA Administrator

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A pencil drawing entitled, "Morning of the Launch at KSC", done on location, shows the Shuttle Orbiter Discovery on Pad 39A waiting to lift-off on April 12, 1985.

Contents

From The Administrator 3
From The Office Of Space Flight 4
Civilian Space Goals For 21st Century America 6
Lunar Soil Produces High Grade Concrete Material 9
Dr. Chang-Diaz Selected For New Medal 10
Space Science To The Crime Lab 10
From The Congressional Record 11
NASA's Quality and Productivity Enhancement Program 13
Discovered Asteroids Could Provide For Future Space Mining 14
NASA Space Technology Enhances Disease Detection 15
New Asteroid/Comet Hazard Studies 16
Did You Know? 16
Contractor News 19
Another Dividend From Air And Space 20

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From the Administrator

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The following is the statement NASA Administrator James C. Fletcher presented to the nation upon receiving the Rogers Commission Report June 9, 1986.

After the Challenger accident, President Reagan told our shocked nation, "The future does not belong to the faint-hearted. It belongs to the brave. . . . "The Challenger crew is pulling us into the future and we must continue to follow them." In words of special meaning to NASA, he said, "We must pick ourselves up again and press on despite the pain."

We have been pressing on, despite the pain, seeking answers to difficult questions, beginning carefully to make changes where they are needed. We have been at work, yet like all Americans, we have awaited the Rogers Commission Report, hoping to learn from it as well.

The report of a Presidentially-appointed, independent body carries with it special status and the compelling obligations to study its conclusions with great care.

We are prepared to do that with an open mind and without reservations.

For over a quarter of a century, certainly since John F. Kennedy pledged in 1961 that we would be on the moon by the end of that decade, the American people have had a special relationship with our space program. They have cheered with us and wept tears of both excitement and sadness. They have seen near perfection. They have seen absolute tragedy.

Certainly, many people were skeptical of that promise to go to the moon. But our space pioneers — who gave their hearts and souls, as they continue to do, to the program—made that promise come true.

Who will forget the moment when we landed men on the moon? People in this country and around the world wept with joy as we accomplished the seemingly impossible. America never stood taller. Heads of state and common folks both cheered.

Who will forget the space walks and the experiments and the photographs of a universe we understand better for the genius and accomplishments of NASA and its associates.

Recently and unfortunately, those positive images were blurred by a horrible accident. Confidence which arose from an unprecedented string of successes was crushed with the Challenger tragedy. Early tears of joy were replaced with bitter tears as people wept with sadness and some anger when we suffered the loss of seven brave astronauts.

Today, the Rogers Commission has issued its report on the event which has already received widespread and deserved coverage in the media and deep and serious consideration within this agency. Its conclusions, no matter how tough, how pointed, how questioning they may be, are not unexpected and certainly not entirely undeserved.

We — and I mean all of us at NASA — will be studying the Commission's judgments and recommendations carefully and thoroughly during the days ahead. We will be offering to the President and to all Americans our specific responses in an orderly and timely way.

The report deserves that kind of thoughtful treatment. To give it less is to insult a distinguished group of citizens who are serious and concerned about what went wrong . . . who have spent several months dealing with difficult questions. It was a task which they undertook as public servants whose sole purpose, I believe, was to seek the truth and to help our national space program.

They are determined, as is NASA, to ensure that this program will become as good as it ever was and as good as it ever can be. Their report, I am also sure, was not and is not intended to sound the death knell of this agency, of the space explorations that distinctively mark the ingenuity of this century and the next.

We at NASA welcome the report. It was obviously time for a serious, thoughtful, constructive review of the agency. We have been the object of America's respect for a long time. We cannot take this respect for granted in today's environment. Like an old marriage, this relationship between the American people and their space program requires honesty and periodic review. That can only lead to a better understanding and a refreshing of that loyalty.

Every administration from President Eisenhower through President Reagan has been generous and supportive. The Congress has been interested and involved. We have responded, giving this country much to be proud of, much to stir the simple and intense pride of being an American, as we worked openly through good times and bad.

I have accepted the President's call to make this agency as vibrant and careful as it can be, to help it earn the respect it deserves and the excellence that has been its hallmark.

We will achieve those goals in a more restrictive atmosphere than we have been accustomed to. Like other departments and agencies of government, we work under the severe budget limitations and restrictions of our time.

And that is proper. Unlike other agencies, our failures are immediately visible, our failures endanger lives and property, our latitude for error extremely narrow. But we cannot and will not sacrifice safety concerns to budget limitations.

We are going to behave like a family which has suffered a tragic event. We are going to deal responsibly with our loss, without needless recrimination, and we are going to move forward, facing and conquering the challenges that face us.

Where management is weak, we will strengthen it. Where engineering or design or process need improving, we will improve them. Where our internal communications are poor, we will see that they get better.

This is an agency whose excellence and commitment to new frontiers drew to it seven exceptional Americans. Our response must be to overcome our errors, not to quit, to stop, or to cave in. To stumble now in hesitation is to mock their commitment to reaching for distant horizons, and their willingness to take a chance in seeking knowledge and understanding.

Let me conclude by repeating my thanks to the Rogers Commission, for undertaking a tough job and working commendably through long weeks toward their conclusions. Their work, I give you my sacred pledge, will not have been in vain. And I think I speak for all NASA employees when I say that. We are in a very special way, an agency with a mission determined, now to regain our honor in its fullness. This is a day of tension for us, but it is also a day of resolve, a time of beginning, and a time of rededication.

Thank you.

From the Office of Space Flight

The Associate Administrator of the Office of Space Flight, Rear Admiral Richard Truly, presented this statement before the Committee on Science and Technology House of Representatives, Washington, D.C.

Mr. Chairman and Distinguished Members of the Committee:

During the months since I returned to duty with NASA following the tragic loss of Challenger, I, along with my entire organization, have spent many hours in support of the Rogers Commission. We have done our best to assist them in the conduct of their investigation, and I have reviewed the Commission report to the President. I find it to be extremely thorough and comprehensive. I am in general agreement with all findings and recommendations and am pleased to say that because of our close association with their work, I have been able to anticipate the corrective actions required to safely return the Space Shuttle to flight. These corrective actions were initiated by my memorandum of March 24, 1986, and a subsequent memorandum by Mr. Aldrich on March 28, 1986, which directed the Shuttle program to undertake this task. These memoranda are included as enslosures to this statement. I would now like to briefly take each of the Commission's recommendations, and provide you with a summary status of my work.

SOLID ROCKET MOTOR (SRM) DESIGN

On March 24, I directed Marshall Space Flight Center (MSFC) to form a SRM joint redesign team to include participation from MSFC and other NASA centers as well as individuals from outside NASA. This team was formed with Mr. John Thomas as its leader. The team includes personnel from JSC, KSC, LaRC, industry, and the astronaut office. In addition, an expert advisory panel was appointed to assist the redesign team. This panel includes 12 people of whom half are from industry. As a result of an early suggestion from the Commission, Dr. Fletcher requested the National Research Council (NRC) to appoint an independent oversight committee to review the activities of the redesign team. The NRC has agreed and the members of the committee have recently been announced.

The redesign team is currently pursuing several options for redesign of the joint with a tentative date for the Preliminary Design Review this summer. Let me assure

you that safety, not schedule, is and will continue to be our primary concern. We will not return to flight status without a safe, tested and certified design. We welcome the assistance of the NRC oversight committee, and I intend to work very closely with them, just as I did with the Rogers Commission, to assure full and complete consideration of their recommendations.

SHUTTLE MANAGEMENT STRUCTURE

The Presidential Commission recommended a thorough review of the Shuttle program structure. On March 24, I initiated detailed review of the NSTS management structure to determine those changes both technically and philosophically that are necessary in order to make the STS a more effective organization. I wholeheartedly support the recommendations to reassess and redefine the responsibilities of the STS Program Manager and to ensure that he has the specific type of authority suggested in the commission report. I intend to reevaluate the Level I/II/III program management concept and to implement any changes necessary to strengthen that structure and to reduce the potential for conflict between the program organization and the institution both at Headquarters and in the field. Utilization of present and former members of the astronaut office will be given proper consideration in that process. I concur completely in the concept of a Shuttle Safety Panel reporting to me and will initiate action to implement this concept and personally leave my door open to them as we move forward.

As you know, Dr. Fletcher has asked General Phillips to review all aspects of NASA program management and this internal Shuttle overview will be accomplished in close coordination with General Phillips.

CRITICAL ITEMS REVIEW AND HAZARD ANALYSIS

In response to my direction, on March 28 Mr. Aldrich initiated a review of all items on the Critical Items List. As a first step, all CRIT 1 and 1R item waivers were cancelled and NASA is in the process of a complete review and reevaluation activity for all items on the list. Those CRIT 1 and 1R items which are not revalidated by the review must be redesigned, certified, and qualified for flight. All other CRIT 2 and 3 items are being reviewed to ensure proper categorization. This reveiw has been under way for some time.

SAFETY ORGANIZATION

Although Safety, Reliability, and Quality Assurance (S, R & QA) is not my direct responsibility, I am vitally concerned about this activity and pledge to work closely and do what I can to strengthen this most important element of our program. The NSTS program does perform many of the activities that relate to program safety and all are under thorough review at this time. Each person in the agency has an obligation to put safety first and this will be reiterated many times over the next months. Within the STS program I intend to ensure that the management structure and its system is modified so that reporting requirements are clearly defined and rigidly enforced, and management at all levels is informed of all significant issues and their current status.

IMPROVED COMMUNICATIONS

I think this may be the most important part of the Commission's work, and that it applies to all our people and organizations. As part of my overall review and restructuring of the management system for the STS, internal and external communication will be given primary consideration. This activity will include MSFC and all other shuttle program organizations and will ensure that the specific recommendations of the Commission will be considered.

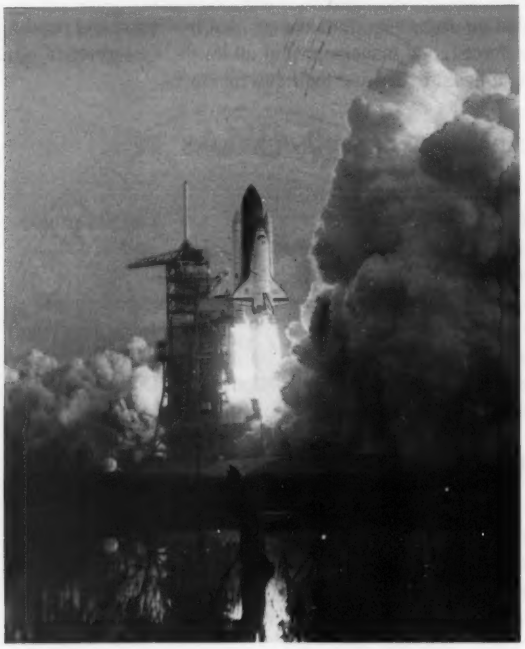
LANDING SAFETY

Landing safety has been a significant concern of the program from the days of our approach and landing tests of the "ENTERPRISE." All shuttle hardware and systems are undergoing design reviews to insure compliance with the specifications and concern for safety. The tire, brakes, and nose wheel steering systems are included in this activity, and funding for a new carbon brakes system has been approved. Specifically tire and brake testing is currently scheduled for this summer. KSC runway surface testing had been underway for sometime prior to the accident and is continuing. Better methods of weather forecasting and weather related support are being evaluated at this time. The potential for increased landings at Edwards Air Force Base was recognized prior to the accident and will be a dominant factor in our schedule as we return to flight status. Dual ferry capability has been a desire for some time and will be thoroughly considered during the upcoming months.

LAUNCH ABORT AND CREW ESCAPE

On April 7, Mr. Aldrich initiated a STS Crew Egress and Escape review. The scope of this analysis includes egress and escape capabilities from launch through landing and will provide analyses, concepts, feasibility assessments, cost and schedules for pad abort, bailout, ejection systems, water landings, and powered flight separation. In conjunction with this activity we are also

reviewing all launch abort rules and philosophy to ensure that launch commit criteria, flight rules, range safety systems and procedures, landing aids, runway configurations and lengths, performance versus abort exposure, abort and end of mission landing weights, runway surfaces, and other landing related capabilities provide the proper margin of safety to the vehicle and crew.



FLIGHT RATE

NASA is actively participating with other governmental agencies in a comprehensive review of the nations ability to assure access to space. I concur with the mixed fleet concept to avoid reliance on a single vehicle. Development of a NASA flight rate which maximizes safety dictates that we fly at a rate consistent with our resources and I intend to develop a schedule which achieves such a rate. Our payload assignment policy and flight manifesting are under my personal review, to assure both that our rules are clear and that we have the discipline to reduce the late changes which cause such an upheaval in the flight planning process.

MAINTENANCE SAFEGUARDS

The STS maintenance philosophy and its implementation, particularly with regard to our spares inventory, is currently under review since shortly following the accident. The results of this activity will be integrated with the results of our S, R, & QA review to develop an overall plan for vehicle processing, maintenance, trend analysis, structural inspections, and spare parts.

Mr. Chairman, I came to this job in the weeks following this tragic accident with the resolve and duty to assist the Presidential Commission in finding the cause. The Commission has done their work; I embrace their report and believe that I have set into motion the initial steps to return the Space Shuttle to safe and effective flight. Their report is a roadmap for me, and I intend to use it as my mandate for action. Thank you for the opportunity to testify before your Committee today, for NASA needs your support and guidance as our Nation returns to space flight.

Civilian Space Goals for 21st Century America

The Presidentially-appointed National Commission on Space released its year-long study of a bold civilian space program for 21st century America. The Commission calls upon the Nation to establish a step-by-step effort to create a "Highway to Space" and a "Bridge between Worlds" which open the inner Solar System for scientific inquiry, exploration and enterprise and leads to the first human outposts on the Moon by 2005 and Mars by 2015.

As stated in its report, the 15 members of the Commission want the United States . . .

> "To lead the exploration and development of the space frontier, advancing science, technology, and enterprise, and building institutions and systems that make accessible vast new resources and support human settlements beyond Earth orbit, from the highlands of the Moon to the plains of Mars."

As mandated by Congress, the Commission undertook a prospective look at U.S. space activities, projecting outward the next 50 years of the Space Age in order to formulate a bold agenda for America's civilian space enterprise. "I believe a basic theme which comes out of our study, and is the heart of the matter," stated Dr. Thomas O. Paine, Chairman of the Commission, "is that the American space program will be what America decides to make it."

In issuing the report to both the President and the Congress, Dr. Paine explained that "the power of technology is so great, not only today, but as we see it advancing over the next 20 years, that it will be the decision of America, and the leadership that we provide to the rest of the world, that will determine what the

world of the 21st century will be like. We're not predicting it, we are simply trying to say what we can make happen."

To develop a new long-range civilian space program, the Commission proposed a future-oriented civilian space agenda with three mutually-supportive thrusts:

- Advancing our understanding of our Solar System, and the Universe;
- Exploring, prospecting, and settling the Solar System; and
- Stimulating space enterprises for the direct benefit of the people on Earth.

These thrusts are judged by the Commission to be of comparable importance. To accomplish them economically, the Nation must make a long-range commitment to two additional thrusts:

- Advancing technology across a broad spectrum to assure timely availability of critical capabilities; and
- Creating and operating systems and institutions to provide low-cost access to the space frontier.

The Commission foresees new economical cargo and passenger transport vehicles to low Earth-orbit, augmented by the addition of a transfer vehicle for destinations beyond. These three systems would be available in conjunction with an "Earth Spaceport"—a transportation point in space for passengers and cargo—within 15 years. By the year 2000, robotic lunar surveys would have begun, with one objective to look for hidden caches of water, frozen at the lunar poles. Following these unpiloted investigations, lunar outposts to support astronauts would be established by about 2005, leading eventually to permanent bases on the Moon. The stretch to the planet Mars and its moons by astronauts would begin a decade later.

To accomplish these milestones, the Commission envisions an evolutionary network of spaceports near Earth, orbiting the Moon and Mars, and in a special location between the Earth and Moon, known as a Libration (L1) Point. Connecting the L1 Spaceport and the spaceport circling Mars would be "cycling spaceships," continually traveling between the orbits of Earth and Mars. The cycling spaceships, constructed similar to the spaceports, would allow routine access to the planet Mars. The Commission emphasizes that a U.S. return to the Moon and expeditions to Mars should not merely constitute brief expeditions, but set the stage for longer, systematic explorations—"eventually we will come to stay."

The proposed evolutionary steps as envisioned by the Commission can be realized within reasonable budget levels in an expanding economy. The Commissioners contend that their proposed 21st century civilian agenda is an investment which will remain below half of the highest percentages spent on the civilian space program during the peak Apollo years.

As stated in the Commission's report, "In view of the increasing significance of space and the critical economic importance of U.S. scientific and technological preeminence in the next century, we believe that these estimated levels of expenditure are reasonable in relation to the expected benefits to our Nation and the world."

Three specific changes to improve the management of America's civilian space program were recommended in the Commission report:

- Twenty-year civilian space program and 5-year budget planning to establish long-range goals and budgets for review and decision by the Administration and the Congress.
- Multi-year procurements to replace year-by-year funding, with firm decisions that eliminate annual changes which have proven very costly to NASA and its contractors.
- Two-year overall approval of civilian space budgets by the Office of Management and Budget and the appropriate Congressional committees to replace annual line-by-line auditing.

In addition, the Commission recommended reestablishment of a National Aeronautics and Space Council (as provided for by Congress in the NASA Act). This Council would be part of the White House organization and would develop the strategies and subsequent plans for new national space goals, ensuring prompt and effective cooperation and coordination among the Government agencies and departments responsible for the overall progress of America's space programs.

The phased growth of capabilities by the Commission would permit the opening of the space frontier for science, exploration and enterprise. The three hallmarks of this pioneering program are (1) economy through technological advances that reduce costs, (2) sustained investment to extend capabilities step-by-step, and (3) robotic processing of local resources to "live off the land," rather than supplying materials from Earth.

With regard to the prospects for international cooperation in our space future, the Commission strongly feels that collaborative efforts can help America fulfill its goals in space sooner and less expensively. The potential for U.S.-Soviet space ventures, the Commission believes, should be coordinated parallel missions, rather than joint ones. Within these guidelines, selective cooperation with the Soviet Union should be actively pursued. As for relationships with countries such as

those in Western Europe, Japan, and Canada, the Commission recommended that continued cooperative space projects be pursued vigorously, with due regard for reciprocity and the protection of U.S. commercial interests.

The new space program the Commission proposes for 21st century America would return many benefits, serving as an exciting medium for the ingenuity of private companies, both established or entrepreneurial. The Commission anticipates tangible benefits from our future enterprise in space taking three forms:

- By "pulling-through" advances in science and technology of critical importance to the Nation's future economic strength and national security.
- By providing direct economic returns from new space-based enterprises that capitalize upon broad, low-cost access to space.
- By opening new worlds on the space frontier, with vast resources that can free humanity's aspirations from the limitations of our small planet of birth.

Calling the Solar System "our extended home," the

"The Report of the National Commission on Space charts a bold course for our nation, one designed to maintain United States leadership in space well into the 21st century and one that reflects the aspirations and vision of the American people."

—NASA Administrator James C. Fletcher.

Commission believes that ". . . space technology has freed humankind to move outward from the Earth as a species destined to expand to other worlds." As part of the rationale for exploring and settling the Solar System, the Commission asserts:

> "With America's pioneer heritage, technological preeminence, and economic strength, it is fitting that we should lead the people of this planet into space. Our leadership role should challenge the vision, talents, and energies of young and old alike, and inspire other nations to contribute their best talents to expand humanity's future."

The National Commission on Space realizes that the value of the report rests upon the extent to which its recommended space goals for 21st century America are adopted and acted upon. If the decision is made to proceed on the civilian space strategy as outlined by the Commission, the detailed review, planning, and budget preparation should be carried out by NASA in consultation with other agencies. The Comission has recommended that the President and the Congress direct the Administrator of NASA to review the Commission's findings and proposed space agenda, and by December 31, 1986, to recommend a long-range implementation plan, including a specific agenda for the next 5 years.

It is the view of the Commission that the immediate benefits from advances in science and technology and from new economic enterprises in space will be many and varied. In removing terrestrial limits to human aspirations, the execution of the Commission's proposed space agenda for 21st century America will prove of incalculable value to planet Earth and to the future of our species.

Lunar Soil Produces High Grade Concrete Material

Experimenting with ⅓ cup of NASA-supplied lunar soil samples, scientists created a concrete product stronger than concrete made with Earth materials.

Researchers at the Construction Technology Laboratory (CTL), Skokie, Ill., studied the strength and characteristics of the lunar sample to determine its suitability as an ingredient of construction grade concrete. Preliminary results revealed that concrete material made from lunar samples achieved a strength of 10,800 pounds per square inch (psi). This is about 5 percent stronger than equivalent, high-strength Earth concrete.

According to Dr. T. D. Linn, CTL principal research engineer, tests performed on a 1-inch cube and three slabs of lunar concrete provided evidence that lunar material will be useful for building concrete structures on the moon. "We are quite pleased that early results show the lunar concrete is of a higher quality than any developed using Earth materials. In previous tests, over a one-and-a-half-year period, using quartz sand, the highest rating attained was 10,260 psi," said Linn.

Current American Concrete Institute standards require a rating of 4,000 psi for slab and 5,000 psi for column, the most critical requirement in constructing buildings.

Linn said prior to the tests, the lunar soil was examined under a scanning electron microscope to determine its physical properties and appeared to make good concrete material. He added that lunar concrete contained no organic substances as is found in Earth concrete materials, which generally is considered an impurity.

The lunar soil sample was allocated to the Linn research team by NASA's Johnson Space Center, Houston, where the lunar rock collection is housed. The repository contains nearly 850 pounds of lunar material returned to Earth by Apollo astronauts from six manned missions to the moon.

According to respository curator Dr. Blanchard, "In supplying Dr. Linn and his associates with the lunar sample, we had hoped to study how we might use some of these materials to make a lunar base a viable opportunity. The results from Dr. Linn's investigations are very interesting. The fact that lunar cement behaves like high quality concrete made with Earth materials proves that it apparently works."

NASA planners anticipate a return to the moon after the turn of the century and the establishment of a permanent lunar base. Such a facility would require a variety of construction techniques designed for long-term life support in the harsh environment of the moon.

Emphasizing that the results are preliminary, Dr. Wendell Mendell, Johnson planetary scientist said, "These results, while they are preliminary in nature, are extremely interesting. We want to see what additional conclusions can be obtained from further examination of the data." Explaining the significance of the lunar soil tests, Dr. Mendell said, "Concrete is one of several materials being considered for building on the moon. If you can make a brick on the moon, you save a great deal of money. That's a tremendous incentive for learning to use lunar materials."

The proposal to study lunar soil as a possible source of building materials was made by CTL in 1984. The Lunar and Planetary Sample Team, a peer review panel which advises the lunar materials program at Johnson,

approved the proposal to provide the lunar sample for study in the fall of 1985.

CTL is a non-profit research facility sponsored by the Portland Cement Association. Results from the lunar soil tests will be made available to the general public.

Dr. Franklin R. Chang-Diaz Selected to Receive the New Medal of Liberty

Dr. Franklin R. Chang-Diaz, the first NASA Hispanic-American astronaut to fly in space, was selected on March 1, 1986 as one of twelve outstanding naturalized American citizens to receive the Medal of Liberty, a new and prestigious national honor.

The Medal of Liberty is a new U.S. Government medal established this year to recognize living naturalized American citizens which have made significant contributions in their fields and to America's way of life. This medal is similar in prestige to the medal of Freedom.

The Medal of Liberty was presented to the twelve recipients by the President of the United States on the evening of July 3, 1986 aboard the aircraft carrier USS John F. Kennedy in New York harbor at the official unveiling of the Statue of Liberty and the relighting of her torch.

The selection of the twelve recipients was delegated to the Medal of Liberty Committee, chaired by Lee A. Iacocca. Researchers and historians from the Medal of Liberty Committee researched a large number of records to obtain names and qualifications of naturalized American citizens. The vast list of candidates thus obtained was whittled down to 200 considered to be the most significant. Biographies and accomplishments of these 200 were circulated and studied by the voting members of the Medal of Liberty Committee and the selection of the twelve recipients was accomplished by balloting of the members.

Dr. Chang-Diaz is the only recipient of Hispanic background in this illustrious group. He is also the only Federal government career employee and the youngest member in the group.

This selection is a great honor bestowed on Dr. Chang-Diaz, as well as a well deserved recognition of the contribution of NASA in general and the Astronaut corps in particular to American society.

The twelve illustrious recipients selected were:

Name	Field	Country of Origin
• Dr. Henry Kissinger	Former U.S. Secretary of State	Germany
• Mr. I. M. Pei	Architect	China
• Mr. Irving Berlin	Music Composer	Russia
• Dr. Hannah Holburn Gray	President - University of Chicago	Germany
• Dr. Kenneth Clark	Psychologist	Jamaica
• Mr. Elie Wiesel	Author - Chronicler of the Holocaust	Rumania
• Dr. Albert Sabin	M.D. - Developer of the Oral Polio Vaccine	Russia
• Mr. James B. Reston	Pulitzer Prize winning journalist, N.Y. Times columnist	Scotland
• Dr. An Wang	Corporate Executive	China
• Mr. Itzhak Perlman	Violinist	Israel
• Dr. Franklin R. Chang-Diaz	Astronaut - NASA	Costa Rica
• Mr. Bob Hope	Entertainer	England

Space Science to the Crime Lab

Criminals soon may be hurting from the heat of a space age spinoff proposed by a NASA scientist and a university law professor.

Dr. Jacob I. (Jack) Trombka of Goddard Space Flight Center, Greenbelt, Md. and professor Sam Dash of Georgetown University Law Center, Washington, D.C. have proposed the adaptation of state-of-the-art space exploration techniques and instrumentation for use in crime detection analysis, investigation and deterrence.

Their premise is that developments in these areas are out of touch with techniques, technology and hardware which are readily available.

As Dash and Trombka see it, many rugged, portable detectors developed for space applications could be used

by mobile police crime lab technicians at the crime scene for chemical analysis of evidence to support their investigations.

The instrumentation which the two envision "transplanting" from a basically out-of-this-world habitat to Earth include neutron, gamma ray, x-ray, infrared, mass spectrometer and magnetometer devices.

Eventually, computer banks of investigative data would be compiled by specialty crime labs around the world and exchanged by law enforcement agencies through an international communications satellite network.

The two innovators cited various types of soils at the crime scene as an example of evidence which yields a detectable, tell-tale x-ray signature.

Armed with this signature, investigators then would query the appropriate lab for identifying data from the computer data bank of the specialty lab concerned via communications satellite.

With the computer-generated data in hand, investigators would have a powerful weapon for interrogation of the suspect, criminal charges and later conviction—not to speak of deterring similar crimes.

The law professor-scientist team recently outlined the space-age-to-the-crime lab proposal to the Secretary of Justice of Puerto Rico who currently has their proposal under consideration.

Commenting on the current state of criminal investigation, Dash said that, for example, "Handwriting analysis techniques date to 1609—we're talking more than 350 years ago—and they haven't changed since."

Further amplifying the need for state-of-the-art crime techniques, Trombka added that, "Most police today simply collect evidence at the crime scene but do not analyze it. The analysis must wait for later—often much later—with the use of heavy equipment at the crime lab. This presents the possibility of critically late identification and contaminated evidence." The Goddard scientist reasoned: "The more quickly we can identify and analyze—such as through mobile nuclear sensors and computer data banks—soil particles, bloodstains, hair, etc., the better the chance of apprehending criminals."

After identifying the problems of crime solving and deterrence through years of research, Dash and Trombka now have brought their proposal through the development stage and to the point of feasibility demonstration.

The Dash-Trombka proposal also can help reduce the chances of human error in the classification and analysis of evidence, improve the efficiency of the investigation, increase the credibility of the prosecution effort and, therefore, enhance the probability of justice being served.

From the Congressional Record

Senator Howell Heflin provided the following remarks on materials processing in space

Routine access to space creates great opportunity for the development and manufacture of materials of types and purities heretofore unavailable. Advanced high speed computers, lifesaving drugs, environment cleaning catalysts, new metals and glasses, and much more, are literally just beyond the horizon. This, largely, is made possible through the almost total escape from the Earth's gravitational forces into what is known as a microgravity environment. Here, warm air does not rise and liquids freeze uniformly instead of first from the surface. A constant and nearly perfect vacuum is readily available.

The potential of manufacturing materials in space is immense. Just as the rockets and spacecraft of the 1960's led to the multibillion-dollar telecommunications industry of today, manned space laboratories promise to engender an equally rewarding revolution in materials processing. The development of new materials in space will lead to an era of technological leadership for the Nation which opens this frontier. In fact, international competition has already begun. The United States, Japan, European nations and the Soviet Union have begun vigorous pursuit of these rewards. The challenge is there and we must meet it.

In pursuing this challenge there are several factors which must be examined including potential products, elements of the competition and the need.

Semiconductor materials have been at the very heart of the many products which have driven the current technological revolution. They are used for computing and data processing applications, for telecommunications, for sensor materials for military and medical usage, and for a wide variety of other electronic applications. In fact, millions of new careers have resulted from our ability to produce better and better semiconductor materials for communications and data processing components. And many now believe that we are approaching a second revolution in information processing through the utilization of light rather than electrons to communicate and store data.

The ability of semiconductors to process and store this information is dependent on the quality of the

crystals from which the semiconductors are made. Large, uniform crystals free of contaminants provide the best materials for electronic and optical use.

Although materials scientists have succeeded in producing very high quality silicon for current applications, the gravitational effect known as thermal convection has limited their ability to produce more advanced materials capable of faster switching over a wider temperature range and which allow optical rather than electronic processing. The microgravity environment of space with its absence of thermal convection is expected to effectively eliminate previous uncontrolled variations in crystals made from such advanced semiconductor materials as gallium arsenide, indium antimony and mercury caldium telluride. In turn, these tremendous improvements in crystal quality should lead to revolutionary new applications in advanced computers, optical microcircuits and in sensors capable of responding to a very broad spectrum of light, ranging from microwaves and heat to x-rays and gamma rays.

Pharmaceuticals already are being developed commercially in space. In the last decade, biomedical researchers have uncovered a myriad of hormones, enzymes, and other substances which have had beneficial effects on people.

Because of sedimentation and buoyancy, both effects of Earth's gravity, many of these potentially lifesaving chemicals cannot be purified or produced in quantities allowing their routine use in the treatment of common illnesses. Other pharmaceuticals are totally impossible to formulate on Earth. However, all can become available in the microgravity of space laboratories.

Among the medical problems for which space-produced pharmaceuticals hold promise are cancer, diabetes, anemia, dwarfism, and hemophilia. Additionally, current research indicates the possibility of producing drugs which may reduce the need for blood transfusions during surgery.

Escape from Earth's gravity also eliminates the need to process materials within a container. This freedom allows production of glasses that cannot be duplicated on Earth where materials first freeze at the points of contact with the walls of the vessels in which they are contained. Also, most glasses are cooled from a very molten state which readily dissolves the materials from which glass crucibles are made. This introduces impurities which compromise the clarity and uniformity of the glass produced.

Containerless processing in microgravity laboratories will allow purer, more uniform glasses of new materials. This should lead to new applications for optical fiber materials which need fewer repeated stations.

Microgravity processing of metals will enable metallurgists to develop new alloys and establish reference standards against which to apply Earth-based research and development. This may lead to new forms of lightweight structures for aircraft and rockets to new high strength cast iron and steel, to new superconducting magnetic alloys and, indeed, to new understanding of fundamental metal properties.

Manufacturers of such traditional products as automobiles and farm implements already are conducting space-age research into new alloys,

Additional products for which new applications are being investigated include uniform calibration standards, molecular sieves and new nylon-like polymers. The first commercial cell of a space-based material was of monodisperse latex spheres which are used as a calibration standard for filters.

Molecular sieves produced under microgravity conditions promise to open new applications of gas separations, membranes for medical uses and purification of environmental pollutants and radioactive waste. Ultra high strength nylon fibers produced in microgravity are now being investigated by American industry.

Materials processing in space is being vigorously pursued by many nations. The nation which open this new frontier will be the leader of a new technological era. Those nations already active in this area are:

The United States performed a few simple experiments during the Skylab Program in 1973-74 and in the Apollo-Soyuz Test Program in 1975. This was followed by a long period of relative inactivity restricted to tests on a few very brief sounding rocket flights.

For the United States, the development of materials processing in space did not reach an appreciable level of activity until the introduction of the space shuttle in 1981. Since then, microgravity processing experiments have been carried aboard shuttle orbitors in almost every flight.

Several dozen American companies now have taken steps to secure a role in microgravity materials processing. Those which have invested their own resources to develop commercial opportunities in space range from some of the Nation's largest corporations to small entrepreneurs. They include industries involved in chemicals, metals, communications, aerospace and automotive products, farm machinery, and pharmaceuticals. Within the last year, a total of 34 companies and 12 universities have established 4 consortia to perform joint research in microgravity processing.

The Russians flew their first microgravity processing experiment in 1975 during the Apollo-Soyuz Test Program. They then embarked on a long-range experimental development program aboard the SALYUT

manned space stations, and have had materials processing equipment in space continuously since 1978.

In contrast to the American program of sporadic, independent experiments, the Soviets have demonstrated a remarkable capacity for performing extended directed research. It has been estimated that the Russians, in total, have performed more than 1,600 materials processing experiments in the SALYUT space stations with international cosmonaut crews which have included East Germans, Poles, Hungarians, Cubans, Czechs, and Vietnamese.

Most of the Soviet Union's attention appears to have been directed at three semiconductor materials; gallium arsenide, indium antimonide and mercury cadmium telluride. Semiconductors using these materials are extremely valuable for military systems. They can be used for high speed computing and the development of radiation resistant signal processors and infrared sensors used for military applications. Any advantage that the Soviets gain in the ability to produce semiconductors of these high quality materials would readily translate to a strategic advantage in developing high speed, radiation resistant, high quality radars, sensors and missile guidance and navigation systems. The Soviets claim to have already manufactured and used for medical purposes infrared sensor devices which were made with mercury cadmium teluride produced aboard SALYUT.

In 1983 the Russians incorporated into the SALYUT system an unmanned re-entry module which can return up to 500 kilograms (1,100 pounds) of materials to Earth between crew visits to the station. Earlier this year, the Soviets stated that they will assemble and orbit large production complexes with semiconductor-materials production facilities, research laboratories and hothouses.

The Europeans and Japanese are expected to fly repeated missions aboard the space shuttle. The Europeans have already carried out a number of materials processing experiments in the space shuttle's space lab, operated by American and European scientists. West Germany flew a space lab mission in 1985 which focused on microgravity processing. The crew included two scientists from West Germany and one from Holland.

Recently, West German companies have established a new consortium, named IntoSpace, chartered to market its space processing opportunities to European industry, particularly those currently not involved in aerospace activities. The Japanese are scheduled to fly a Spacelab mission in 1988, focusing their attention on microgravity processing.

There seems little doubt as to the seriousness with which our allies—and others—intend to compete in this new commercial arena made possible by routine access to space.

Materials processing work will continue aboard the space shuttle once shuttle flights are restored. However, the shuttle will be flying only about once a month, and even then, it is in orbit for only about a week at a time. This is hardly long enough to perform the needed detailed development program. The key need is the permanently orbiting, manned space station now planned by NASA.

The space station will contain a laboratory for microgravity processing with the capability to perform the whole range of materials development necessary, from basic research through process development, technology advancement, commercial process prototyping, and commercial production of materials. Once in orbit in the 1990's, the space station will provide American science and industry the opportunity to gain and maintain a position of technological leadership in the applications of advanced materials into the 21st century. This leadership will be manifested in new forms of lifesaving drugs, in advanced computers, fluid processes, and in a new understanding of metals and glasses. It will lead to prosperity and to military strength and security.

Just as the development of orbital satellites has led to new jobs and economic growth in the telecommunications industry and as improved processing of silicon materials has led to great gains in the computer industry, advanced materials processing in space will bring about economic growth, security and improved medical care to our generation and those to follow.

Forecast For NASA's Quality and Productivity Enhancement Program

David R. Braunstein, who recently vacated his office as Director of NASA's Productivity Programs to assume a new managerial position at Douglas Aircraft in Long Beach, California, leaves behind a legacy of innovative productivity concepts and programs that will continue to have far-reaching impact on the American aerospace industry.

Mr. Braunstein had been a member of the NASA family since February 1980, at which time he held the position of Deputy Associate Administrator for Manage-

ment in NASA's Space Shuttle Office. Two Exceptional Service Medals for management accomplishments were awarded to Mr. Braunstein during this period of service.

Prior to joining NASA, he was Director for Program Management with the Defense Advance Research Projects Agency (DARPA) from 1975 until 1980. While working for DARPA, he received the Secretary of Defense Meritorious Civilian Service Medal for management improvements. Mr. Braunstein had previously participated in the President's Executive Interchange Program.

Mr. Braunstain's ability to conceive ideas on a scale designed to extend the program's innovative concepts has resulted in a number of on-going executive achievements: the inception in 1984 of the NASA/Contractors Conference, now an annual affair; the 1984 Symposium on "Improving Quality and Productivity in Government and Industry" which ultimately led to the nine themes underpinning the productivity improvement and quality enhancement program; and the Government Quality Conference conducted for the first time in 1985.

In his remarks to NASA management staff at a recent Administrator's Reception held in his honor, Mr. Braunstein noted: "As I look forward to the future, I would like to make a prediction; a forecast based on the continued success of the Productivity Improvement and Quality Enhancement Program as an integral part of NASA's management philosophy.

I predict that in ten years, we will enjoy greater levels of trust between the contractor and government; the field installations and Headquarters; the executive and legislative bodies; and finally, between Union and Management.

We will come to expect, and receive, higher levels of quality from office, laboratory, and supplier resulting in a more superior product.

We will see the acceptance at NASA of a continuous improvement philosophy; the replacement of antiquated equipment with that of modern, and more comprehensive training programs. The Manager will act as both coach and team leader, encouraging employee contributions.

I predict that in fifteen years, organizations will routinely measure productivity and quality. Customer satisfaction will again emerge as a highly desired objective; quality of management and growth of productivity will work hand in hand with employee participation."

Mr. Braunstein will be remembered at NASA not only for his distinguished performance as the Agency's first Director of Productivity Programs, but also for his vision and dedication to performance improvement and product quality as goals of particular importance in NASA management thinking today. His efforts have led to NASA's being recognized as the leader in Government for productivity improvement and as one of the leading organizations in the Nation making progress to improve national productivity.

Newly Discovered Asteroids Could Provide for Future Space Mining

Studies of the makeup of two newly discovered asteroids that could possibly provide the basis for future mining in space were announced by astronomers and colleagues at NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif.

In work at several observatories, the astronomers have established that two near-Earth asteriods are probably composed chiefly of nickel-iron metal, much like some asteroids in the main asteroid belt and meteorites that impact Earth.

Astronomers previously suspected that such near-Earth asteroids were extinct comets. As such, they would have probably originated in the far outer solar system where comets are believed to have formed.

Nickel-iron asteroids, on the other hand, would have probably formed in the inner solar system. Most would have originated along with objects in the main asteroid belt orbiting the sun between Mars and Jupiter. Metallic near-Earth asteroids, however, may have begun as part of the cloud of material that condensed and became Earth.

One of the two asteroids studied, designated 1986 EB when it was discovered earlier this year, is known as an Aten-class asteroid — one whose orbit is inside Earth's. The other, designated 1986 DA, belongs to the Amor class — asteroids whose orbits are close to Earth's, but which are beyond Earth's orbit and do not cross it. Both are about one mile in diameter.

The observations were made by planetary astronomers Dr. Edward Tedesco of JPL and Dr. Jonathan gradie of the University of Hawaii.

Using the 120-inch NASA Infrared Telescope at Hawaii's Mauna Kea Observatory, they found that the two asteroids have spectral qualities and albedo that put them in the same class as metallic asteriods of the main asteroid belt (albedo refers to an object's reflectivity). Astronomers study the light, or spectra, of an object to determine its chemical composition.

Tedesco made later observations at Arizona's Kitt Peak National Observatory with Dr. Robert Nelson of JPL and at Mauna Kea with Dr. Marc Buie of the University of Hawaii.

The astronomers noted that metallic asteriods near-Earth might provide suitable sites for future mining

operations in space, as has been proposed to provide raw materials for possible interplanetary expeditions in the 21st century.

NASA Space Technology Enhances Disease Detection

Scientists and medical researchers at NASA's National Space Technology Laboratories (NSTL), Bay St. Louis, Miss., are using satellite remote sensing technology to assist in developing a new method of analyzing the human body, including disease detection and tumor and blood clot analysis.

The use of advanced remote sensing technology as a medical research tool in a new body scanning technique, known as nuclear magnetic resonance (NMR), began in April 1985. The project is a 3-year collaborative effort between Washington University's Mallinckrodt Institute of Radiology, St. Louis, Mo., NASA Kennedy Space Center, Fla., and NSTL.

According to Doug Rickman, one of two NSTL Earth Resources Laboratory scientists working on the project, NMR hardware has been in existence since the 1940s. However, it has been used recently as a diagnostic tool by physicians. NMR scanning is regarded as an improvement over CAT SCAN, an X-ray technique sensitive to bone density. NMR, however, is sensitive to soft tissue and allows doctors to make more accurate diagnosis of diseases because of NMR's capability to show images of soft tissues in the body.

At NSTL, Rickman and fellow scientist Jim Anderson have applied the NASA-developed software, used in processing satellite imagery, to enhance the NMR images. This process is expected to improve the accuracy of disease detection. By incorporating the software into the system, NMR scans provide better information on a tumor's size and location as well as its biological attitude. Doctors can more easily get an accurate status of a tumor's mass without having to enter the body surgically.

The cooperative effort between NASA and Washington University began in 1980 because of the similarity of multispectral medical data and multispectral satellite data. However, NMR-produced data are black-and-white images and, therefore, are difficult to interpret. Currently, the images resemble X-rays and are treated as such by doctors making diagnosis.

NASA scientists hope to make medical diagnosis simpler by assigning color values to enhance the computer images. Kennedy Space Center, in a joint effort with the University of Florida, made the initial color composites. The work at NSTL seeks to improve the enhanced color images by training the NMR scanner to be consistent in identifying materials in the body, as a means of insuring the unit's maximum use potential.

Rickman said: "The color images ease the physician's task, which should make it more accurate in the long run. It is quite difficult to interpret the black-and-white images but simple to interpret the color ones."

Dr. Michael Vannier, radiologist and principal project investigator, believes the union with NASA is vital to maximize the potential of NMR scanning. "No one in medicine really has the kind of experience with classifying or analyzing these types of images this way. That's why we're using NASA expertise to help us," Vannier said.

According to Vannier, the NMR has been used on a number of organ systems in the brain. Recently, the National Cancer Institute, Bethesda, Md., expressed interest in NMR because of its potential use in breast diagnostic techniques. Doctors John Gohagen and Ed Spitznagel, both of Washington University, were selected by the Cancer Institute to work along with Vannier, as representatives of the institute-sponsored Breast Imaging Project.

Gohagen emphasizing the importance of close affiliation with pathologists while working with actual cases to determine the accuracy of image classification. He said, "Our goal is to get the kind of discrimination necessary to distinguish anamolous conditions. For example, blood clots will appear distinctly different from benign tumors and a marked difference will be evident between benign and malignant tumors."

Explaining the project objective, NSTL scientist Anderson stated, "The NMR images in their present black-and-white format are useful to the physician, but we're talking about a quantum leap forward using NASA image processing. Our purpose is to produce a product which can be used by the physician to enhance or finalize the diagnosis."

"What we expect this type of technology to do," Vannier concluded," is to help us answer a lot of very specific questions that influence the management of patients. I think it will have a significant effect on what we do in the future."

New Asteroid/Comet Nuclei Hazard Studies Announced

New studies of the hazards posed by asteroids or comet nuclei colliding with the Earth, based on analyzing old craters on the Earth and Moon, have been announced by astronomers performing research for NASA.

In two papers delivered May 20 at the annual meeting of the American Geophysical Union in Baltimore, Md., the scientists estimate that a collision by a large asteroid could be catastrophic. The chances of such an event occurring in the next century, however, are extremely remote.

A scenario of greater concern, they said, would be a far more probable encounter with a smaller object, a large meteoroid. Objects of that size explode when they enter the atmosphere. Such an explosion could be mistaken by some of the world's less technically advanced nations for a nuclear attack, prompting undesirable political consequences.

The papers were authored by Dr. Alan Harris, a Jet Propulsion Laboratory planetary scientist, and Dr. Eugene Shoemaker, a U.S. Geological Survey scientist who serves in NASA's Planet-Crossing Asteroid Program.

In one paper, Harris and Shoemaker estimated that the odds of an asteroid or comet nucleus one-third mile in diameter or larger hitting the Earth in the next 100 years are only 1 in 1,000.

In the other paper, Shoemaker calculated the effects of collisions by asteroids of various sizes. An asteroid one-third mile in diameter would release energy equivalent to 10,000 megatons of TNT and leave a crater six miles in diameter.

Despite the low probability of such a collision, the astronomers said, systematic sky searches for near-Earth asteroids, combined with advance emergency planning, are prudent steps to reduce further the possibility of an unexpected disaster.

"Increase in the discovery rate of these objects from an average of 3 to about 30 per year can be achieved with a moderate level of research support," Harris said.

Over 30 to 50 years, he said, most Earth-crossing asteroids down to about one-third diameter can probably be discovered.

If a collision was forseen, it would be possible to predict the time and impact location with high accuracy, allowing the threatened area to be evacuated.

Some day, Harris noted, it may be possible to avoid a collision altogether, either by modifying the asteroid's orbit or breaking it up into a relatively harmless swarm of smaller pieces. The energies required for either strategy would require thermonuclear energy.

Comets are more difficult to predict than asteroids. Asteroids usually occupy orbits similar to the Earth's, making the object visible longer in advance if it were to approach the Earth. Comet orbits, on the other hand, are highly elliptical, bringing them in from the outer solar system with less advance warning.

Nevertheless, tracking of the comet and evacuation of the impact area would be practical means of avoiding a major disaster.

The scientists emphasized that such large events are extremely improbable, placing more concern on the effects of a meteoroid up to about 330 feet in diameter entering Earth's atmosphere. Events of that size are estimated to occur once every few decades. One such event was probably responsible for a nuclear-device-like explosion over Tunguska, Siberia in 1908.

The world's most technically advanced nations would be able to identify such a meteoric fireball for what it is. Nations lacking that technical ability, however, could mistake the fireball for the air burst of a nuclear weapon and attempt retaliation against hostile neighbors.

That issue, they recommend, should be addressed at the international level.

Harris and Shoemaker arrived at their statistical probability by analyzing and dating craters around the Earth and on its Moon.

Did You Know?

NASA, in association with The Atlanta University Center, Inc., hosted the first annual NASA-HBCU (Historically Black Colleges and Universities) FORUM, April 20-22, 1986 at Atlanta, Georgia.

The Forum, provided HBCU's and NASA an opportunity to present accomplishments in research and student development.

More than 250 students, professors and administrators from HBCU's attended. Featured guests include Dr. Frank McDonald, NASA's Chief Scientist; US Congressman Mervyn Dymally; and Isaac Gillam, Assistant Administrator-Commercial Programs, Dr. Harriett Jenkins, Assistant Administrator, Equal Opportunity Programs, NASA; Charles Bolden, Astronaut/Pilot, NASA and top scholars from America's Black colleges and universities.

Students presented more than 50 papers relating to various aspects of NASA and space exploration.

Through the Forum, attendees received a comprehensive view of the present and future NASA-HBCU relationships and the participation of industry and other governmental agencies.

The Forum was conducted under the direction of the office of NASA Chief Scientist in cooperation with The Atlanta University Center's Dolphus E. Milligan Science Research Institute.

NASA will sponsor a major conference on the planet Mars, to coincide with the tenth anniversary of the Viking missions that explored Mars in 1976. The conference will be held July 21-23, 1986, at the National Academy of Sciences in Washington, D.C.

The conference will be sponsored by the Solar System Exploration Division of NASA's Office of Space Science and Applications.

The purpose of the conference is to take a comprehensive look at present knowledge and understanding of Mars; present and future exploration of the planet; and issues and options for further manned exploration.

Subjects to be discussed will include the geology, volcansim, channels, moons, meteorology, polar regions and biology of Mars. Exploration programs considered will include observer missions, aeronomy, seismic network, sample return and the 1988 Russian Mars program. Discussions of human exploration will include transportation systems, key technologies and life support.

Anyone interested in the history, science and exploration of Mars is invited to attend the conference. Attendance will be first-come, first-served, and limited to 600 people.

For further information, write to The Mars Conference, Mrs. Lu Agee, P.O. Box 416, Hampton, Va. 23669. Telephone (804) 865-8400.

Successful ground testing of a unique auxiliary propulsion system for Space Station marked a milestone in NASA's program to demonstrate that such thrusters can operate for long periods with no hardware degradation.

A key element in this new technology development is the viability of using the electrolysis of water onboard Space Station as the propellant source for the thrusters. In this process, water is broken down into hydrogen and oxygen and these gases are then burned as the fuel.

The tests were conducted for NASA's Lewis Research Center, Cleveland, by Aerospace Textron, Buffalo, N.Y., and Aerojet TechSystem Corp, Sacramento, Calif. Under parallel contracts awarded in 1985, the two companies are charged with design, fabrication and test of small (25-to-50-pound) thrusters based on technology developed by NASA's Office of Aeronautics and Space Technology.

The thrusters ran for as long as 22,000 seconds. With a target of some 10 years of Space Station life, a run of 40,000 to 60,000 seconds is the goal. Banks of these thrusters will be used onboard Space Station to maintain proper orbit and attitude.

NASA will bring an all-new exhibit featuring the National Aerospace Plane to this summer's EAA OSHKOSH '86.

The air-breathing space plane, referred to by President Ronald Reagan as the "Orient Express" during his State of the Union address, will be capable of flying at speeds up to Mach 25 in the upper atmosphere from the West Coast of the United States to Tokyo in just two hours, for example. Comparable subsonic flights require more than 10 hours.

The 6,000 square-foot exhibit facility will be filled with examples of NASA research tools and exploratory techniques necessary for 21st century aircraft. Increasing computer capabilities are among the many areas currently being studied by NASA researchers. For example, the agency's Ames Research Center in Mountain View, CA, has a new "supercomputer and simulation complex" that will soon be capable of performing 1 billion computations per second. Complex measurements of aerodynamic flow fields that once took days or weeks to perform will now take only minutes. The aerospace industry and universities will soon be able to make use of this resource.

Another highlight of NASA's EAA OSHKOSH '86 presence will be four of the agency's test pilots and their aircraft. Research pilots are an important part of many flight research programs conducted at NASA centers around the country. Flying an interesting mix of missions in a variety of aircraft, some of these pilots might well be the first ones to take America's aerospace plane into orbit.

Other displays that will be featured at EAA OSHKOSH '86 are NASA's first exhibit of aeronautical art that includes works from the nation's foremost artists; a close look at rotorcraft research and potential applications; and examples of NASA's aeronautical research and development efforts that will be located throughout the new display area.

The three NASA aeronautics field centers supporting this year's EAA OSHKOSH exhibit are Langley Research Center in Hampton, VA; Lewis Research Center in Cleveland, OH; and Ames Research Center in Mountain View, CA, which includes the Dryden Flight Research Facility at Edwards Air Force Base.

For the second consecutive year, the Goddard Space Flight Center in Greenbelt, MD, will provide its SARSAT van, a mobile exhibit that presents an overview of the Search and Rescue Satellite system.

During testimony to the House Committee on Science and Technology, James C. Fletcher, NASA Administrator, and Rear Admiral Richard H. Truly, NASA Associate Administrator for Space Flight, announced that astronaut Robert L. Crippen (Capt., USN) has been assigned to head a small group which will examine the overall Space Shuttle program management. Where changes to existing organization or lines of authority are deemed appropriate, the group will recommend solutions for approval.

This review was part of the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident, headed by William P. Rogers, to flight status, issued March 24. In this plan Truly stated, "The National Space Transportation System (NSTS)) program management philosophy, structure, reporting channels and decision-making process will be thoroughly reviewed and those changes implemented which are required to assure confidence and safety in the overall program, including the commit to launch process."

Crippen's group will review the findings and conclusions of the Rogers Commission leading up to the Commission's recommendations on Shuttle management structure, the use of astronauts in NASA management positions, the creation of a Shuttle safety panel and improved communications within the Shuttle program. Part of the review process will entail discussions with former NASA managers (e.g., previous associate administrators) and others inside and outside NASA to solicit their opinions and advice on the subjects of the study. Other members of the group will be announced later.

On announcing the assignment, Truly said, "Captain Crippen, a veteran of four Shuttle flights, is extremely well qualified to lead this project by virtue of his extensive experience in several NASA programs including the Shuttle.

NASA and Boeing Aerospace Company, Seattle, WA., have entered into an agreement to fly a series of materials processing experiments on the Space Shuttle.

Objective of the experiments is to prove that crystals of a size and quality impossible to create on Earth can be produced in space. These crystals are expected to be of a type valuable in the commercial production of semiconductor and electro-optic devices.

The experiments involve the manned operation of a chemical vapor transport crystal growth furnace which will be installed in the galley area of the Shuttle orbiter mid-deck compartment.

Boeing expects to fly a total of three separate furnaces on each of the three flights. The Univertsity of Alabama, Huntsville, with which Boeing is affiliated under the NASA program of Centers for the Development of Space, also will perform experiments in the Boeing furnaces during the flight program. There is an option for two additional flights for prototype production experiments if the program yields promising results.

Under the agreement, Boeing will fund the experiments, provide the crystal growth furnace and other needed equipment. Boeing also will process some NASA samples in its furnace on each flight. NASA agrees to integrate the experimental packages into the Space Shuttle, provide available off-the-shelf support equipment where applicable and provide room and crew support on Shuttle flights.

NASA's involvement in this agreement and others underscores the agency's commitment to the development of commercial endeavors in space, particularly in relation to the Space Station.

The American Historical Association named the first recipient of an annual aerospace history fellowship jointly sponsored by the Association and NASA. He is Dr. Norriss Hetherington, Research Associate at the University of California, Berkeley. While the history of astronomy has been Dr. Hetherington's principal area of research, he will devote his fellowship year to the study of early aeronautical research.

The American Historical Association annual fellowship in Aerospace history is designed to attract both junior and senior scholars to the study of modern aerospace history from a variety of perspectives.

NASA Ames-Dryden Flight Research Facility engineer Marta R. Bohn-Meyer became one of only a handful of American women who have flown at supersonic speeds above 50,000 feet.

Bohn-Meyer flew as flight test engineer in the rear seat of a F-104 aircraft that Ames-Dryden uses to fly experiments requiring very low gravity conditions, similar to those found during Space Shuttle flights. One experiment flown previously was to observe the low gravity effect on solidifying molten cast iron.

Flights above 50,000 feet require use of a pressure suit. Bohn-Meyer's preparations included altitude chamber and survival training while wearing the suit.

"The whole experience was really neat, so different and unique, something I never expected to experience in my life," says Bohn-Meyer. "People really put a lot of effort into my training and a lot of faith in me. I hope to repay them by doing the best job I can."

NASA announced plans to procure a Tracking and Data Relay Satellite (TDRS) to replace the one lost in the Challenger accident.

Plans call for a replacement spacecraft and follow-on satellites to keep the TDRS system operational through the end of the century. NASA will procure the replacement spacecraft with parts for a second spacecraft from

TRW, Electronics and Defense Sector, Redondo Beach, Calif., on a sole source basis. Value of the contract will be negotiated with TRW. Delivery of the replacement spacecraft is scheduled for September 1991.

A TDRS follow-on study will be initiated in late 1986 leading to a decision to competitively procure advanced, follow-on spacecraft with deliveries planned to begin in 1996.

The currently operational TDRS 1 is in geosynchronous orbit over the Atlantic Ocean just east of Brazil (41 degrees west longitude).

Contractor News

NASA Lewis Research Center, Cleveland, selected **G. R. Osterland Company,** Cleveland, for final negotiations leading to award of a cost-plus-award-fee, 5-year contract valued at approximately $22 million for routine construction, modification and maintenance services. All work will be performed on-site.

The contractor will be responsible for interior and exterior painting, insulation and asbestos removal, roof repair, road and parking lot repair, demolition work, electrical heating and air conditioning, piping and other general repair and rehab of Lewis facilities.

NASA's Johnson Space Center, Houston, selected **Stellacom, Inc.** for negotiations of a cost-plus-award-fee contract for Center television support services.

The contract, which started June 1, 1986, will be valued at about $4.3 million, JSC has the option to extend the contract for one-year periods.

Stellacon will operate the JSC closed-circuit television system and videotape library, process Shuttle Orbiter downlink television, provide technical support for press conferences and teleconferencing, produce training tapes, supply all television engineering, and maintain/repair all television equipment.

Stellacom is a joint venture of Avid Productions, Inc. of Houston and Third Coast Video, Inc. of Austin, Texas.

NASA's Ames Research Center, Mountain View, Calif., entered into a Small Business Innovation Research contract with **ACA Industries,** Palos Verdes, Calif., to build the advanced concept joined wing. Initial flight tests are planned by ACA Industries for early 1988 at Mojave, Calif. The estimated value of this 2-year contract is approximately $500,000.

The joined wing is an advanced aircraft design incorporating a swept-back main wing that is joined, close to its wing tips, to a swept-forward rear wing. Stronger aircraft structures and increased fuel efficiency are the primary benefits anticipated.

The purpose of the program, declared NASA's Dr. David J. Peake, Chief, Advanced Aerodynamic Concepts Branch at Ames and Robert Baron, Project Office, Ames-Dryden Flight Research Facility, Edwards, Calif., is to build, ground certify and flight test a joined-wing research/flight demonstrator aircraft.

NASA selected **Bamsi, Inc.,** Titusville, Fla., for final negotiations leading to the award of a 5-year support services contract, effective July 1, 1986. As a competitively negotiated procurement, the first 3 years of the contract has a proposed value of $9 million.

Bamsi, Inc. will provide on-site maintenance support services and incidental construction at Ames Research Center, Mountain View, Calif. This contract will provide personnel, material, equipment and other resources necessary to perform maintenance services in the following general areas: electrical services, mechanical services, plumbing, pipe-fitting and utility services, building trades service, and heating, air conditioning, environmental and refrigeration systems services.

Micro Craft Inc., Tullahoma, Tenn. and Hampton, Va., and **DEI-East Inc.,** Newport News, Va., were selected for negotiation of individual contracts to design and fabricate precision aerospace models for wind tunnel tests at NASA Langely Research Center, Hampton, Va.

The models delivered under the contracts will support the overall NASA aeronautics research program and may include advanced aerospace, DOD, commercial and general aviation configurations.

Two cost-plus-award-fee contracts will cover a period of 3 years, with 2-year options. Total value of the combined contracts is approximately $20 million.

Wind tunnel models must accurately represent the aerodynamic shapes, aeroelastic properties or dynamic properties as required for particular tests.

The two companies will build models of various scale sizes, which may have complex contoured shapes and highly cambered and twisted wings with controlled shapes and finishes. Exacting dimensional tolerances and surface finishes may be required for wind tunnel models. Some models may be tested at temperatures as low as minus 300 degrees F. Others may be tested at temperatures as high as 2,000 degrees F.

The companies will build the models at their facilities.

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

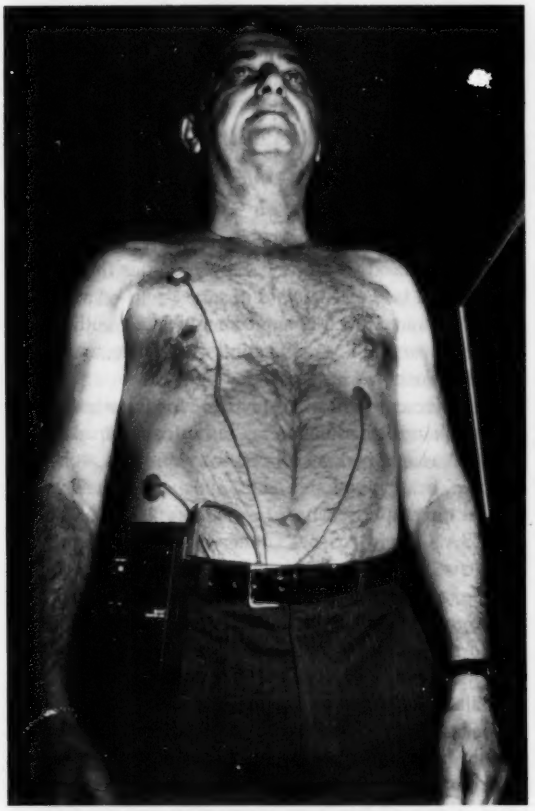
Heart Monitor

MONITOR ONE, a portable, computerized cardiac system offers physicians a new approach for monitoring ambulatory patients with coronary artery disease. The cardiac monitor, alerts the patient to impending high-risk cardiac events by continuously evaluating the electrocardiographic signals generated by the heart. MONITOR ONE, which incorporates NASA technology, is the product of three years of research and development by Q-Med Inc., Clark New Jersey.

Approximately six inches long and three inches wide, MONITOR ONE weighs 14 ounces; it may be attached to a patient's garment or carried in a pocket, and it does not interfere with daily routine.

MONITOR ONE may be worn for days, weeks, months or years. It evaluates every heartbeat and makes immediate decisions as to the normalcy or abnormalcy of the beats. Each abnormal event defined by the computer is stored for later review by the physician, who may program various thresholds for different patients. MONITOR ONE not only enables a physician to track a patient's progress over a long period, but also allows him to evaluate the efficacy of drug treatment and to adjust dosages accordingly.

MONITOR ONE was developed by three cofounders of Q-Med Inc. They recognized early in the R&D program that the key to successful development of an ambulatory mode system was the electrode—it had to last for long periods, provide high fidelity and not require constant skin abrasion in order to function properly. NASA's Johnson Space Center Houston, Tx., had successfully developed advanced electrodes for monitoring the heart action of Space Shuttle astronauts. The Q-Med team learned of the JSC technology and tested samples of the NASA electrodes; they proved to be ideal for MONITOR ONE. Q-Med was granted an exclusive license to manufacture and market the electrodes and in August 1984 the company was advised by the Food and Drug Administration that it could begin marketing the MONITOR ONE system. Initial deliveries



of MONITOR ONE, manufactured for Q-Med by Rodale Electronics, Garden City, New York, were made last January.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.